DOCUMENT RESUME

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ABSTRACT

This document contains the course syllabus and 12 independent practice modules for a college level mathematics course designed to provide the necessary foundation for success in calculus, develop logical thinking skills, and enhance analytic skills through problem solving. Topics include relations and functions; inequalities; complex numbers; quadratic equations; linear and quadratic systems of equations; higher degree equations; trigonometric functions; identities and equational functions of a composite angle; graphs of the trigonometric functions; logarithms; and binomial formula. Information given in this syllabus includes: (1) textbook; (2) references; (3) grading criteria; (4) course description; (5) course procedures; (6) behavioral objectives; (7) course outline; and (8) prerequisite. (CW)

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NEW YORK INSTITUTE OF TECHNOLOGY
CENTER FOR THE NATURAL SCIENCES
DEPARTMENT OF MATHEMATICS

COURSE OUTLINE

MATH 3011 - COLLEGE ALGEBRA AND TRIGONOMETRY

PREREQUISITE: MATH 3008, 3013 OR EQUIVALENT

INSTRUCTOR:_____ OFFICE TELEPHONE:_____

OFFICE LOCATION:_____ OFFICE HOURS:_____

GRADING CRITERIA:

Exams (3)	48%
Quizzes	12
Homework Modules	12
Final (departmental and comprehensive)	28
	100%

No one will be exempted from the final exam. The final exam grade itself must be higher than 40, regardless of the quiz/exam average, in order to pass the course.

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COURSE DESCRIPTION:

Topics include relations and functions, inequalities, complex numbers, quadratic equations, linear and quadratic systems of equations; higher degree equations; trigonometric functions, identities and equational functions of a composite angle; graphs of the trigonometric functions, logarithms and binomial formula.

BEHAVIORAL OBJECTIVES:

1. To provide the necessary mathematical foundations required for success in calculus.
2. To develop the students ability to think logically by presenting sound mathematical arguments.
3. To enhance the students analytic skills through problem solving.

TEXTBOOK:

ALGEBRA AND TRIGONOMETRY: A FUNCTIONS APPROACH, Keedy and Bittinger, Fourth Edition, Addison-Wesley Publishing Co.

REFERENCES:

COLLEGE ALGEBRA, Rees, Sparks and Rees, McGraw-Hill

COLLEGE ALGEBRA AND TRIGONOMETRY, Ratti, MacMillan

ALGEBRA AND TRIGONOMETRY, Sobel and Lerner, Prentice Hall

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Rev. 6/87

NEW YORK INSTITUTE OF TECHNOLOGY
CENTER FOR THE NATURAL SCIENCES
DEPARTMENT OF MATHEMATICS

COURSE OUTLINE

MATH 3011: College Algebra and Trigonometry
TEXTBOOK: Algebra and Trigonometry: A Functions Approach, Fourth Edition, M.L. Keedy and Marvin Bittinger, Addison-Wesley Publishing Co.

MODULE	SECTION	TOPIC	PROBLEMS
1	2.4	Quadratic Equations: Solution by Factoring, Comp. the Square, Formula; Discriminant (1-26)*	pp.78-79: 3,5,9,11,17,19,23,27,29, 31,33,39
	2.6	Radical Equations (1-4)	p.87: 1,3,5,9,13,15
	2.7	Equations Reducible to Quadratic (1-4)	pp.91-92: 1,3,5,9,17
2	3.1	Relations and Ordered Pairs (2-7,9-11)	p.110: 3,5,7,11,13,15
	3.2	Graphs of Equations (1-13)	p.116: 1,5,9,13,15,17,23,27
	3.3	Functions (1-13)	pp.125-126: 1,3,11,13,15,17,21,23
	3.6 (i),(vi)	Some Special Classes of Functions Even and Odd; Function Defined Piecewise (1-4,16)	pp.146-148: 1,2,3,5,9,11,13,15,35,37
3	3.6 (iii)	Interval Notation (8-11)	p.147: 25,27
	4.5	Sets, Sentences and Inequalities (1-27)	pp.186-187: 1,3,5,7,9,11,15,17,21, 27,29,37
	4.6	Inequalities with Absolute Values (1-12)	p.190: 1,3,5,17,19,25,27,29,37
	4.7	Quadratic Inequalities (1-7)	pp.194-195: 1,5,7,17,19,21,23,27,31
4	5.1	Systems of Two Equations: Unique Solutions, Applied Problems (4-11)	pp.206-207: 5,9,11,13,15,17,19
	5.2	Systems of Three Equations: Unique Solutions (1-2)	p.212: 1,3,5,7
	5.3	Inconsistent and Dependent Equations (1-9)	p.218: 1,3,5,9,13,15,17
	5.5	Determinants and Cramer's Rule (1-10)	pp.225-226: 1,3,5,7,9,10,11,13,15, 17,21
5	7.2	Logarithm Functions (1,4,7-27)	pp.279-280: 7-20,21,23,25,27,31,33, 35,37
	7.3	Properties of Logarithmic Functions (1-15)	p.283: 1,3,5,7,9,15,17,19,21,23,27, 29,31,33,35,37
	7.4	Common Logarithms (9-14,16)	pp.289-290: 63-77 (odd),79,81,83, 87,89
6	8.1	The Unit Circle (1-9)	pp.309-310: 7-17 (odd)
	3.6 (ii)	Periodic Functions (5-7)	p.147: 21,23
	8.2	The Sine and Cosine Functions (1-3,5-10,12,13)	pp.317-318: 1-21 (odd)
	8.3	The Other Circular Functions (1-27)	pp.325-326: 1-10,13-27 (odd)
7	8.4	Some Relations Among the Circular Functions (1-7)	p.330: 1-9 (odd)
	8.5	Graphs: Sine, Cosine (1-6)	pp.334-335: 1,3,7,11,13,17,19,21
	Supplement	Graphs: Tangent, Cotangent	$y = -2\tan x, y = \cot\frac{1}{2}x, y = 2\tan(x + \frac{\pi}{4}), y = -\cot(2x - \frac{\pi}{3})$
	8.7	Rotations and Angles (1-10,14)	pp.345-346: 1-13 (odd),19,29,31,33, 39,41,43

MODULE	SECTION	TOPIC	PROBLEMS
8	8.8	Trigonometric Functions of Angles (1-11,13-15)	pp.356-357: 7-17 (odd),21,29,33,43, 45,47
	8.9	Relationships Among Function Values (1-3)	p.360: 1,3,4,7
	8.6	Algebraic and Trigonometric Manipulations (1-7)	p.338: 1,3,7,9,19,27 p.339 (top): 1,5,7,21,23
9	9.1	Sum and Difference Formulas (1-10)	pp.378-379: 1,3,5,9,11,13,17,19,21, 23,25
	9.2	Some Important Identities: Double Angle, Half-Angle (1-7)	pp.385-386: 3,5,7,11,23,25,27,29,31
10	9.3	Proving Identities (1,2)	p.391: 1-31 (odd)
	11.1,2	Imaginary and Complex Numbers 11.1(1-19,23), 11.2(1-9)	pp.457-58: 1,3,5,7,11,15,21,23,25, 27,29,33,35,37,43 p.462: 1,3,5,13,17
11	12.1	Polynomials and Polynomial Functions (1-11)	p.480: 1,3,7,9,11,15,19
	12.2	Remainder and Factor Theorems (Synthetic Division) (1-8)	pp.483-484: 1-11 (odd),17,19
	12.3	Theorems about Roots (1-13)	pp.487-488: 1-13 (odd),16,19,21
12	12.4	Rational Roots (1-5)	pp.491-492: 1-4,5,7,13,17,21
	15.3	Binomial Series (1-7)	pp.596-597: 1,3,5,7,11,13,14

* The numbers within the parenthesis, ( ) , below each topic, indicate the marginal exercises detailing the material to be covered. Generally, classroom exercises should be drawn from this group.

** Assignments are meant as a guideline of the types and level of difficulty of problems necessary for mastery of 3011 content. Faculty should exercise their own judgment regarding actual assignments.

This outline indicates twelve modules, each approximating a week's study. The remaining class time is for additional instruction, testing and/or review.

1. Find the negative solution: $(1 - 2x)^2 = 16$

   a) $-\frac{3}{2}$ b) $-\frac{5}{2}$ c) $-\frac{15}{2}$ d) $-\frac{17}{2}$ e) -4

2. Solve: $(x + \frac{2}{3})^2 = \frac{4}{9}$

   a) $-\frac{2}{9}, -\frac{10}{9}$ b) $0, -\frac{2}{3}$ c) $0, -\frac{4}{3}$ d) $-\frac{4}{9}, -\frac{8}{9}$ e) $\pm\frac{4}{3}$

3. In solving the equation $x^2 + 7x = 1$ using the method of completing the square, what number needs to be added to each side?

   a) 7 b) $\frac{49}{2}$ c) 49 d) 14 e) $\frac{49}{4}$

   Solve and simplify your answer.

4. $(x - 3)^2 + (x + 1)^2 = 5x$

   a) $\frac{5}{2}, 2$ b) $\frac{5}{4} \pm \frac{1}{4}\sqrt{55}$ c) $-\frac{5}{2}, -2$ d) $\frac{9}{2} \pm \frac{1}{2}\sqrt{41}$

   e) no real solutions

5. $x^2 + 4x - 2 = 0$

   a) $-2 \pm \sqrt{6}$ b) $-4 \pm \sqrt{6}$ c) $-2 \pm 2\sqrt{6}$ d) $-2 \pm \frac{1}{2}\sqrt{24}$ e) $2 \pm \sqrt{6}$

6. $(x - 5)^2 = 2x$

   a) $-6 \pm \sqrt{11}$ b) $6 \pm \sqrt{44}$ c) $1 \pm \sqrt{26}$ d) $6 \pm \sqrt{11}$

   e) no real solutions

   For #7 and #8, determine the nature of the solutions to the given equation. Select one of these answers:

   a) Exactly one real number solution
   b) Two real, rational number solutions
   c) Two nonreal solutions
   d) One real and one nonreal solution
   e) Two real, irrational number solutions

7. $(x + 2)^2 = 3x - 5$

8. $5x^2 - 16\sqrt{2}\,x + 6 = 0$

   For #9 through #11, find an equation of degree two which has the given values as solutions.

9. 5, -7

   a) $x^2 - 12x + 35 = 0$ b) $x^2 - 2x - 35 = 0$ c) $x^2 + 2x - 35 = 0$

   d) $x^2 - 12x - 35 = 0$ e) $x^2 + 12x - 35 = 0$

10. -4 (only solution)

a) $x^2 - 8x + 16 = 0$ b) $x^2 + 8x + 16 = 0$ c) $x^2 - 4x - 4 = 0$
d) $x^2 - 16 = 0$ e) $x^2 + 16 = 0$

11. $-1, \frac{1}{3}$

a) $x^2 - \frac{1}{3} = 0$ b) $x^2 + x - \frac{1}{3} = 0$ c) $x^2 - x + \frac{1}{3} = 0$
d) $x^2 + \frac{2}{3}x - \frac{1}{3} = 0$ e) $x^2 - \frac{2}{3}x - \frac{1}{3} = 0$

12. Which of the following statements is <u>not</u> always true?

a) If $a^3 = b^3$, then $a = b$ b) If $a^2 = b^2$, then $a = b$
c) If $a = b$, then $a^2 = b^2$ d) If $\sqrt[3]{a} = \sqrt[3]{b}$, then $a = b$
e) All of the above are true

For #13 through #15, solve for the variable.

13. $\sqrt[3]{a} = -5$

a) ± 125 b) -125 c) $\sqrt[3]{-5}$ d) $-\sqrt[3]{5}$ e) no real solutions

14. $\sqrt{2x + 3} + 2 = 0$

a) $\frac{1}{2}$ b) $-\frac{7}{2}$ c) $-\frac{1}{2}$ d) $\frac{7}{2}$ e) no real solutions

15. $\sqrt[4]{12 - x} - 3 = 0$

a) -9 b) 69 c) -69 d) 3 e) no real solutions

16. Simplify: $(\sqrt{3x + 4} - x)^2$

a) $-x^2 + 3x + 4$ b) $x^2 + 3x + 4$ c) $x^2 + 3x + 4 - x\sqrt{3x + 4}$
d) $x^2 + 3x + 4 - 2x\sqrt{3x + 4}$ e) $x^2 + 3x + 4 + 2x\sqrt{3x + 4}$

For #17 through #19, solve by squaring both sides. Show the extraneous solutions (those which do not check) as well as the correct solutions.

17. $\sqrt{14x + 8} = 2x$

a) Correct: $-\frac{1}{2}$, Extraneous: 4 b) C: 4 , E: $-\frac{1}{2}$
c) C: 4 , E: $-\frac{2}{3}$ d) C: $-\frac{2}{3}$, E: 4 e) C: 4 , E: $\frac{1}{2}$

18. $\sqrt{a - 2} = 3 - \sqrt{a + 1}$

a) C: 3 , E: 2 b) C: 3 , E: 5 c) C: 3 d) C: -25 e) C: 5

19. $\sqrt{10 - x} - \sqrt{x + 7} = 3$

a) C: -6 , E: 9 b) C: 9 , E: -6 c) C: -6 , E: -3
d) C: 9 , E: -3 e) C: -3 , E: 9

20. If $u = x^{1/3}$ and $u = 8$ then $x =$

a) 2 b) ± 2 c) $\frac{1}{512}$ d) 512 e) no real solution for x

For #21 through #25, find all real solutions for x.

21. $x^4 - 6x^2 - 7 = 0$

a) $\sqrt{7}$ b) $\pm\sqrt{7}$ c) 7, -1 d) ± 1 e) $\pm\sqrt{7}, \pm 1$

22. $x^{-1} - x^{-2} = -6$

a) $\frac{1}{3}, -\frac{1}{2}$ b) $\frac{1}{2}, -\frac{1}{3}$ c) $\frac{1}{3}$ d) -3, 2 e) 3, -2

23. $2x^{\frac{1}{2}} - x^{\frac{1}{4}} = 3$

a) $-1, \frac{81}{16}$ b) $1, \sqrt[4]{\frac{3}{2}}$ c) $\frac{81}{16}$ d) $\sqrt[4]{\frac{3}{2}}$ e) no real solutions

24. $x - 5x^{\frac{1}{2}} = -6$

a) $\sqrt{2}, \sqrt{3}$ b) 4, 9 c) 2, 3 d) $\frac{1}{2}, \frac{1}{3}$ e) no real solutions

25. $(x^2 - 4)^2 + 4(x^2 - 4) - 12 = 0$

a) ± 2 b) -6, 2 c) $\pm\sqrt{6}$ d) $\pm\sqrt{6}, \pm\sqrt{2}$ e) no real solutions

1. The domain of the relation whose ordered pairs are $(-1,2)$, $(3,5)$, $(-1,10)$, $(5,10)$ is:

   a) $\{-1,3,5\}$ b) $\{-1,2,5\}$ c) $\{-1,3\}$ d) $\{-1,2,3,5,10\}$

   e) none of these

2. The range of the relation whose ordered pairs are $(-1,2)$, $(3,5)$, $(-1,10)$, $(5,10)$ is:

   a) $\{-1,2,3,5,10\}$ b) $\{2,5\}$ c) $\{2,5,10\}$ e) $\{2,10\}$

   e) none of these

3. Which of the following is a solution of $x^2 - y^2 = 16$?

   a) $(0,4)$ b) $(0,-4)$ c) $(-4,0)$ d) $(0,0)$ e) $(20,4)$

4. Which of the following is a solution of $xy = 4$?

   a) $(-2,2)$ b) $(-1,-\frac{1}{4})$ c) $(4,0)$ d) $(-16,-\frac{1}{4})$ e) $(-1,4)$

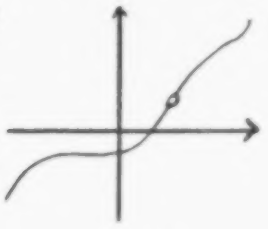
5. Which of the following relations is <u>not</u> a function?

   a) $\{(1,3),(5,3)\}$ b) $\{(-1,5),(2,3),(-1,7)\}$ c) $\{(0,0),(5,0),(-3,0)\}$

   d) $\{(2,5),(-2,-5),(3,1)\}$ e) $\{(0,1),(1,0),(-1,5),(3,7)\}$

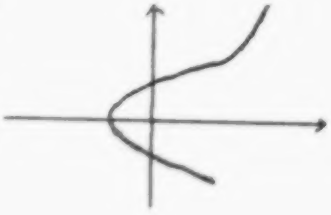
6. Which of the following is <u>not</u> a graph of a function?

   a)

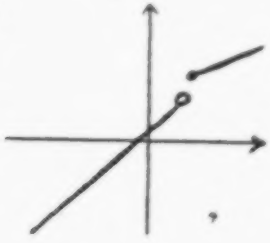


   b)

   c)



   d)



   e)

State the domain of each of the following.

7. $f(x) = 3x^2 - 27$

   a) all real numbers b) no real numbers c) all real numbers except 0

   d) all real numbers except 3 e) none of these

8. $g(x) = \frac{4 + x}{x - 3}$

a) no real numbers b) all real numbers c) all real numbers except 3
d) all real numbers except -4 e) all real numbers except 3 and -4

9. $y = 15$

a) no real numbers b) all real numbers except 15 c) only number 15
d) all real numbers e) all real numbers except 0 and 15

10. $f(x) = \sqrt{5x + 3}$

a) $\{x \mid x \geq 0\}$ b) $\{x \mid x \geq -3\}$ c) $\{x \mid x > \frac{3}{5}\}$ d) $\{x \mid x > -\frac{3}{5}\}$
e) $\{x \mid x \geq -\frac{3}{5}\}$

11. $f(x) = \begin{cases} (x + 3) \text{ if } x \geq 2 \\ \frac{x}{x - 5} \text{ if } x < 2 \end{cases}$

a) no real numbers b) all real numbers c) all real numbers except -3
d) all real numbers except 0 and -3 e) all real numbers except 5

12. $g(x) = \frac{x - 5}{x^2 + 16}$

a) no real numbers b) all real numbers c) all real numbers except ± 4
d) all real numbers except 5 and ± 4 e) all real numbers except 5

13. Given $f(x) = \frac{10}{3 + |x - 2|}$

a) all real numbers b) all real numbers except 10 c) no real numbers
d) all real numbers except 2 e) all real numbers except -3

14. $f(x) = \frac{x}{x^2 - 4}$

a) all real numbers b) all real numbers except 0
c) all real numbers except ± 2 d) all real numbers except -4
e) all real numbers except 0 and ± 2

15. Given $h(t) = \sqrt{5t - 4}$ then $h(0) =$

a) 2 b) -2 c) 1 d) -1 e) does not exist

16. $H(w) = \frac{w + 4}{w - 4}$ then $H(-4) =$

a) 1 b) -1 c) 0 d) 2 e) does not exist

17. $G(s) = \frac{s}{s-2}$ then $G(2) =$

a) 2 b) -2 c) 1 d) -1 e) does not exist

18. $f(x) = \begin{cases} 2x & \text{if } x < 3 \\ -(3-x)^2 & \text{if } x \geq 3 \end{cases}$ then $f(5) =$

a) 10 b) 4 c) 10 and 4 d) -4 e) none of these

19. $g(x) = \begin{cases} -2x + 4 & \text{if } x \leq -2 \\ 3x & \text{if } -2 < x < 7 \\ 5 - x & \text{if } x > 91 \end{cases}$ then $g(10) =$

a) undefined b) -16 c) 30 d) -5 e) -16, 30, -5

20. Given $f(x) = 7$ then $f(0) =$

a) 0 b) 7 c) 1 d) $\frac{1}{7}$ e) does not exist

21. $f(x) = 2x^2 + 3$ then if $h \neq 0$, $\frac{f(a+h) - f(a)}{h} =$

a) $\frac{2a^2 + 3}{h}$ b) $4a + h^2$ c) $4a + 2h^2$ d) 0 e) $4a + 2h$

22. Given $f(x) = 4x^5 + 1$ and $g(x) = 2x - 3$ then $(f \circ g)(x) =$

a) $(8x - 12)^5 + 1$ b) $8x^6 - 2$ c) $4(2x - 3)^5 + 1$
d) $8x^6 - 12x^5 + 2x - 3$ e) $2(4x^5 + 1) - 3$

23. Given $h(x) = \frac{3}{x} + 4$ and $w(x) = 5x^2 - 1$ then $(h \circ w)(x) =$

a) $\frac{3}{5x^2 - 1} + 4$ b) $5(\frac{3}{x} + 4)^2 - 1$ c) $15x - \frac{3}{x} + 20x^2 - 4$
d) $(\frac{15}{x} + 20)^2 - 1$ e) none of these

24. Which of the following is neither an even nor odd function?

a) $f(x) = 3x^3 - x$ b) $f(x) = \frac{x^3 + 1}{x^2 + 3}$ c) $f(x) = 17$
d) $f(x) = x^{17} - x^3$ e) $f(x) = x^2 - |x|$

25. Which of the following is an even function?

a) $f(x) = x^2 + 3x^3 - 3$ b) $f(x) = -\sqrt{x}$ c) $f(x) = x$
d) $f(x) = 3x^4 - 2|x|$ e) none of these

1. Write interval notation for $\{x \mid 0 \leq x < \frac{5}{3}\}$

   a) $(0,\frac{5}{3})$ b) $(0,\frac{5}{3}]$ c) $[0,\frac{5}{3})$ d) $[0,\frac{5}{3}]$ e) none of these

2. Find $\{3,4,5,8,11,12\} \cap \{2,4,8,10,14\}$

   a) $\{2,3,4,5,8,10,11,12,14\}$ b) $\{2,4,8,10,12,14\}$ c) $\{3,5,11\}$
   d) $\{4,8\}$ e) $\{2,3,5,10,11,12,14\}$

3. Which of the following inequalities is <u>not</u> satisfied by any number?

   a) $-4 < x < 0$ b) $4 \geq x > -3$ c) $7 < x < 5$ d) $-2 \leq x \leq -\frac{1}{2}$

   e) they are all valid

4. Graph $\{x \mid x > -4\} \cup \{x \mid x > -7\}$

   a) b) c) d) e) none of these

5. Find $\{k,l,m,n\} \cup \{l,m,n\}$

   a) $\{k\}$ b) $\{l,m,n\}$ c) $\{k,m\}$ d) $\{k,l,m,n\}$ e) none of these

6. Solve: $2 - (5 - 3x) < 6$

   a) $\{x \mid x < 3\}$ b) $\{x \mid x < -3\}$ c) $\{x \mid x < 1\}$ d) $\{x \mid x > -1\}$
   e) $\{x \mid x > -3\}$

7. Solve: $-10(x - 2) \geq 2x + 8$

   a) $x \leq -\frac{7}{3}$ b) $x \leq 1$ c) $x < \frac{3}{2}$ d) $x \geq 1$ e) $x \geq -\frac{7}{3}$

8. Solve: $\frac{1}{6}x - \frac{3}{4} < \frac{3}{8}x - 2$

   a) $x < -6$ b) $x > -\frac{16}{5}$ c) $x > \frac{66}{5}$ d) $x < -\frac{16}{5}$ e) none of these

9. Solve: $-x - 3 < 1$ and $2x - 3 < 0$

   a) $-4 < x < \frac{3}{2}$ b) $x < -4$ c) $\emptyset$ d) $x < \frac{3}{2}$ e) $\frac{3}{2} < x < 4$

10. Solve: $|5 - x| = 3$

    a) $\{x \mid x = 2\}$ b) $\{x \mid x = -2\}$ c) $\{x \mid x = 2 \text{ or } x = 8\}$
    d) $\{x \mid x = 2 \text{ or } x = -8\}$ e) $\{x \mid x = 2 \text{ or } x = -8\}$

11. Solve: $|2x - 3| < 7$

    a) $x < 5$ b) $-5 < x < 2$ c) $x < -2$ or $x > 5$ d) $-2 < x < 5$
    e) none of these

12. Solve: $\left|\frac{x}{3} - 2\right| > 3$

a) $x < -3$ or $x > 15$ b) $x < -9$ or $x > 11$ c) $-3 < x < 15$
d) $x > 15$ e) $x > 11$

13. Solve: $|-2x + 3| \geq 7$

a) $\{x | -2 \leq x \leq 5\}$ b) $\{x | x \leq -2\}$ c) $\{x | x \leq 2\}$
d) $\{x | x \leq -5\} \cup \{x | x \geq 1\}$ e) $\{x | x \leq -2\} \cup \{x | x \geq 5\}$

14. Solve: $|8 - 2x| \leq -4$

a) $x \geq 6$ b) $-2 \leq x \leq 6$ c) $\emptyset$ d) $x \leq 6$ e) $2 \geq x \geq 6$

15. Solve: $x^2 - 3x \geq 0$

a) $x \geq 3$ b) $x \leq 0$ c) $x \leq 0$ or $x \geq 3$ d) $0 \leq x \leq 3$ e) $x \leq 3$

16. Solve: $x^2 + 4x + 2 < 0$

a) no real numbers b) all real numbers c) $2 - \sqrt{2} < x < 2 + \sqrt{2}$
d) $x < -2 - \sqrt{2}$ or $x > -2 + \sqrt{2}$ e) $-2 - \sqrt{2} < x < -2 + \sqrt{2}$

17. Solve: $\frac{x - 1}{2 - x} \geq 0$

a) $-2 < x < -1$ b) $x \leq 1$ or $x > 2$ c) $1 \leq x < 2$ d) $x > -1$ or $x < -2$
e) $1 \leq x \leq 2$

18. Solve: $x^2 + 4x - 12 \geq 0$

a) $[-6, 2]$ b) $\{x | -6 \leq x \leq 2\}$ c) $\{x | x \leq -6\} \cup \{x | x \geq 2\}$
d) $\{x | -6 \leq x \leq 2\}$ e) $\{x | x \leq -6\} \cap \{x | x \geq 2\}$

19. $\frac{3x + 2}{3x} < 5$

a) $2 < 5$ b) $0 < x < \frac{1}{6}$ c) $x > \frac{1}{6}$ d) all real numbers
e) $x < 0$ or $x > \frac{1}{6}$

20. $(x + 1)(x - 2)(x - 5) > 0$

a) $\{x | -1 < x < 2$ or $x > 5\}$ b) $x^3 - 6x^2 + 3x + 10 > 0$ c) all real numbers
d) $\{x | x < -1$ or $2 < x < 5\}$ e) $\{x | x > 5\}$

21. Solve: $\frac{x - 1}{x + 3} > 2$

a) $-3 < x < 5$ b) $x < -7$ or $x > -3$ c) $x < -3$ or $x > 5$ d) $x < -4$
e) $-7 < x < -3$

22. Solve: $2x^2 + x + 1 > 0$

a) no real numbers b) $x > -7$ c) all real numbers

d) $x < \frac{-1 - \sqrt{-7}}{4}$ or $x > \frac{-1 + \sqrt{-7}}{4}$ e) $\frac{-1 - \sqrt{-7}}{4} < x < \frac{-1 + \sqrt{-7}}{4}$

23. Solve: $\frac{(x - 4)(2x + 1)}{x + 2} < 0$

a) $x < -2$ b) $x < -2$ or $-\frac{1}{2} < x < 4$ c) $x < 4$ d) $-2 < x < -\frac{1}{2}$ or $x > 4$

e) none of these

24. Solve: $2x^2 + 9x - 5 \geq 0$

a) $[-5, \frac{1}{2}]$ b) $\{x \mid x \leq -5 \text{ or } x \geq \frac{1}{2}\}$ c) $\{x \mid x \geq \frac{1}{2}\}$ d) $\{x \mid -5 < x < \frac{1}{2}\}$

e) no real numbers

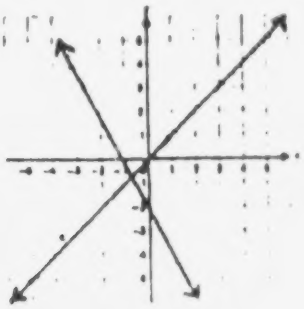
25. Solve: $x^2 - 12x + 36 < 0$

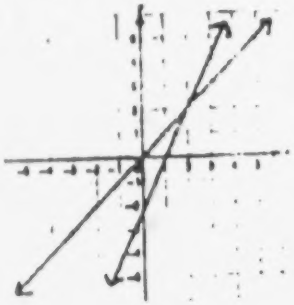
a) $x < 6$ b) $-6 < x < 6$ c) $x < -6$ d) all real numbers

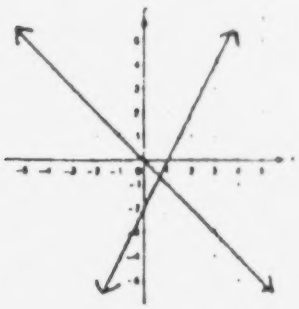
e) no real numbers

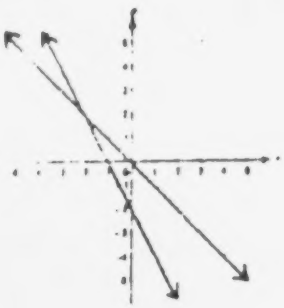
1. Solve graphically the system of equations: $4x - 2y = 4$
$x - y = 0$

The graph looks like which of the following choices?

a) 

b) 

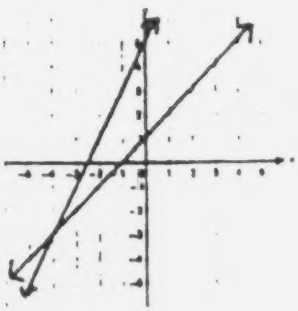
c) 

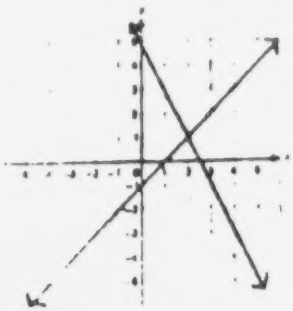
d) 

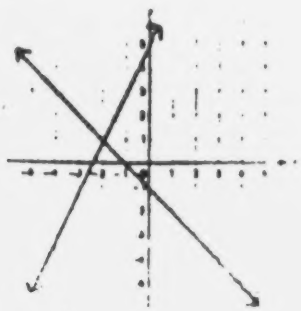
e) none of these

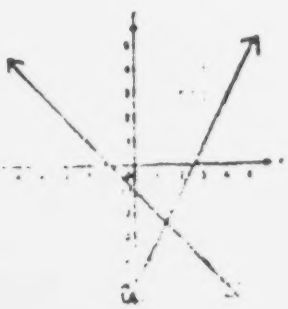
2. Solve graphically the system of equations: $x + y = -1$
$-2x + y = 5$

The graph looks like which of the following choices?

a) 

b) 

c) 

d) 

e) none of these

Solve each system of equations by the method of addition or subtraction.

3. $3x - 8y = -1$ Find $x + y$
   $-5x + 8y = 7$

   a) 7 b) -4 c) 18 d) 2 e) none of these

4. $x + 2y = -1$ Find $x - y$
   $3x + 5y = -4$

   a) -1 b) -4 c) 4 d) 5 e) no solution

Solve each system of equations using the substitution method.

5. $x + 2y = 6$ Find $x + y$
   $4x - 3y = 2$

   a) 4 b) 7 c) 2 d) 11 e) 12

6. $3x - 8y = 2$ Find $x - y$
   $x - 5y = -4$

   a) -1 b) -4 c) 0 d) -10 e) none of these

7. Given the system of equations: $4x + 3y = 10$
   $5x - 2y = 1$

   Select the determinants necessary to solve for x using Cramer's Rule.

   a) $\dfrac{\begin{vmatrix} 4 & 3 \\ 5 & -2 \end{vmatrix}}{\begin{vmatrix} 3 & 4 \\ -2 & 5 \end{vmatrix}}$ b) $\dfrac{\begin{vmatrix} 3 & 10 \\ -2 & 1 \end{vmatrix}}{\begin{vmatrix} 4 & 3 \\ 5 & -2 \end{vmatrix}}$ c) $\dfrac{\begin{vmatrix} 4 & 10 \\ 5 & 1 \end{vmatrix}}{\begin{vmatrix} 3 & 4 \\ -2 & 5 \end{vmatrix}}$ d) $\dfrac{\begin{vmatrix} 10 & 4 \\ 1 & 5 \end{vmatrix}}{\begin{vmatrix} 4 & 3 \\ 5 & -2 \end{vmatrix}}$ e) $\dfrac{\begin{vmatrix} 10 & 3 \\ 1 & -2 \end{vmatrix}}{\begin{vmatrix} 4 & 3 \\ 5 & -2 \end{vmatrix}}$

8. Solve for x: $\begin{vmatrix} x-1 & 3 \\ x-2 & 4 \end{vmatrix} = 8$

   a) 2 b) 18 c) 10 d) 12 e) 6

9. Evaluate: $\begin{vmatrix} -\frac{1}{4} & -\sqrt{3} \\ \sqrt{3} & 8 \end{vmatrix}$

   a) 5 b) -5 c) 0 d) 1 e) none of these

10. Evaluate: $\begin{vmatrix} 3 & 1 & -1 \\ 4 & -3 & 2 \\ 2 & 2 & -3 \end{vmatrix}$

    a) 29 b) -15 c) 15 d) 17 e) 45

Use this system of equations to answer questions #11 and #12:

$$\begin{aligned} x + y + 3z &= 1 \\ 2x - y + 4z &= -2 \\ 3x - 2y + z &= 1 \end{aligned}$$

11. To solve using Cramer's Rule, the x-coordinate of the solution is:

a) $\dfrac{\begin{vmatrix} 1 & 1 & 3 \\ -2 & -1 & 4 \\ 1 & -2 & 1 \end{vmatrix}}{\begin{vmatrix} 1 & 1 & 3 \\ 2 & -1 & 4 \\ 3 & -2 & 1 \end{vmatrix}}$ b) $\dfrac{\begin{vmatrix} 1 & 1 & 1 \\ 2 & -1 & -2 \\ 3 & -2 & 1 \end{vmatrix}}{\begin{vmatrix} 3 & 1 & 1 \\ 4 & -1 & 2 \\ 1 & -2 & 3 \end{vmatrix}}$ c) $\dfrac{\begin{vmatrix} 1 & 1 & 1 \\ 2 & -1 & -2 \\ 3 & -2 & 1 \end{vmatrix}}{\begin{vmatrix} 1 & 1 & 3 \\ 2 & -1 & 4 \\ 3 & -2 & 1 \end{vmatrix}}$ d) $\dfrac{\begin{vmatrix} 1 & 1 & 3 \\ -2 & -1 & 4 \\ 1 & -2 & 1 \end{vmatrix}}{\begin{vmatrix} 3 & 1 & 1 \\ 4 & -1 & 2 \\ 1 & -2 & 3 \end{vmatrix}}$

e) none of these

12. The determinant for the numerator of z is:

a) $\begin{vmatrix} 1 & 1 & 3 \\ 2 & -1 & 4 \\ 3 & -2 & 1 \end{vmatrix}$ b) $\begin{vmatrix} 1 & 1 & 3 \\ -2 & -1 & 4 \\ 1 & -2 & 1 \end{vmatrix}$ c) $\begin{vmatrix} 1 & 1 & 1 \\ -2 & 2 & -1 \\ 1 & 3 & -2 \end{vmatrix}$ d) $\begin{vmatrix} 1 & 1 & 3 \\ 2 & -2 & 4 \\ 3 & 1 & 1 \end{vmatrix}$

e) none of these

Given the following system of equations, solve for the unknown as indicated.

$$\begin{aligned} 2x + 3y - 2z &= -5 \\ x - 2y + 3z &= 13 \\ 3x - y + z &= 10 \end{aligned}$$

13. Solve for x.

a) 2 b) -1 c) 3 d) 16 e) none of these

14. Solve for y.

a) 1 b) -1 c) 2 d) -2 e) none of these

15. Find x + y + z.

a) -1 b) -4 c) 0 d) 4 e) none of these

Solve this system of equations and answer the following questions.

$$\begin{aligned} 3x + y - z &= 1 \\ 4x + y + 3z &= 2 \\ x + y - 4z &= -1 \end{aligned}$$

16. Solve for x.

a) 1 b) -1 c) 3 d) 2 e) none of these

17. Solve for z.

a) -1 b) 0 c) 1 d) -2 e) none of these

18. Find $y + 2z$.

a) 1 b) -1 c) 0 d) 4 e) none of these

19. Classify this system of equations as consistent or inconsistent, dependent or independent:

$$\begin{aligned} 2x \quad + \quad z &= 4 \\ x + y + \quad z &= -2 \\ 3x + y + 2z &= 2 \end{aligned}$$

a) consistent, dependent b) consistent, independent

c) inconsistent, dependent d) inconsistent, independent

e) none of these

20. Solve this dependent system of equations in terms of z.

$$\begin{aligned} 3x + 5y + \quad z &= 0 \\ 2x - 4y - 3z &= 0 \\ x + 3y + \quad z &= 0 \end{aligned}$$

a) $(z-2,\frac{z}{2},z)$ b) $(\frac{z}{2},z+2,z)$ c) $(\frac{z}{2},-\frac{z}{2},z)$ d) $(z-2,-\frac{z}{2},z)$

e) none of these

21. An estate of $150,000 was divided among two sons and one daughter. The sons received equal shares, and their portions totalled $70,000 more than the daughter's share. Find the daughter's share.

a) $55,000 b) $40,000 c) $50,000 d) $70,000

e) none of these

22. One bar of silver alloy is 35% pure silver, and another bar is 75% pure silver. How many ounces of each must be used to produce 32 ounces which will be 40% pure silver?

a) (28,4) b) (20,12) c) (16,16) d) (24,8) e) none of these

23. A man rows 18 miles downstream in 2 hours. He finds it takes him 6 hours to row back. Find his rate in still water and the rate of the stream.

a) 8,4 b) 6,3 c) 10,6 d) 6,4 e) 8,2

24. In a farmer's yard, there are 30 pigs and chickens. Altogether there are 100 feet. How many pigs are in the yard?

a) 10 b) 15 c) 18 d) 25 e) 20

25. A man is engaged to work on a farm for 40 days. He is to receive $20 for every day he works and loses $10 for every day he fails to work. How many days does he work if he collects $500?

a) 25 b) 20 c) 30 d) 35 e) 32

For all examples, assume the base is greater than 0 and is not equal to 1. If the base is not specified, it is assumed to be 10.

1. $(5b^2)^{-3} =$

   a) $-\frac{15}{b^6}$ b) $\sqrt[3]{5b^2}$ c) $\frac{1}{125b^6}$ d) $\frac{1}{125b^{-6}}$ e) $-125b^6$

2. $(36a^8)^{\frac{1}{2}} =$

   a) $6a^4$ b) $18a^4$ c) $6a^{\sqrt{8}}$ d) $\frac{1}{36^2a^{16}}$ e) $36a^4$

3. Write a logarithmic equation equivalent to $y = b^2$.

   a) $\log_2 y = b$ b) $\log_b 2 = y$ c) $\log_b y = 2$ d) $\log_b y^2 = 2$

   e) $\log_y 2 = b$

4. Write an exponential equation equivalent to $\log_e 7.39 = 2$

   a) $7.39e = 2$ b) $\frac{2}{e} = 7.39$ c) $2e = 7.39$ d) $e^{7.39} = 2$

   e) $e^2 = 7.39$

5. $\log_{16} 4 =$

   a) -2 b) $\frac{1}{4}$ c) $\frac{1}{2}$ d) $\frac{1}{8}$ e) 2

6. $\log_2 \sqrt[5]{2} =$

   a) -5 b) $\frac{1}{5}$ c) 5 d) $2^{1/5}$ e) $-\frac{1}{5}$

7. Solve for b: $\log_b 400 = 2$

   a) ± 20 b) 160,000 c) 800 d) 200 e) 20

8. Solve for x: $\log_{10} \frac{1}{x^2} = -2$

   a) $\frac{\pm\sqrt{5}}{10}$ b) 10 c) $\pm\frac{1}{10}$ d) ± 10 e) no real solutions

9. Which of the following is <u>undefined</u>?

   a) $\log_3 1$ b) $\log_3 5$ c) $\log_3 \sqrt[3]{4}$ d) $\log_3 \frac{1}{5}$ e) $\log_3 0$

For #10 and #11, simplify the given expression using $\log_b x = r$, $\log_b y = s$, and $\log_b z = t$.

10. $\log_b x^5$

    a) $5\log_b r$ b) $5r$ c) r^5 d) 5 e) $\frac{r^5}{b}$

11. $\log_b\left(\frac{x}{y^2}\right)$

a) $\log_b r - 2\log_b s$ b) $r - s^2$ c) $r - 2s$ d) $\frac{r}{2s}$ e) $\frac{r}{s^2}$

For #12 through #14, evaluate the given logarithm (to four decimal places), using $\log_b 2 = .6309$, $\log_b 5 = 1.4650$ and $\log_b 7 = 1.7712$.

12. $\log_b 20$

a) 6.309 b) 1.8485 c) 2.7268 d) 0.5831 e) 4.1918

13. $\log_b \sqrt{7}$

a) 1.7712 b) 0.8856 c) -3.5424 d) 1.3309 e) 2.6458

14. $\log_b 0.01$ (Hint: write as a fraction)

a) -2.0959 b) -1.0959 c) $\frac{1}{4.1918}$ d) -4.1918 e) 0.2096

15. Which one of the following statements is <u>false</u>?

a) $\log_b 50 = 2\log_b 5 + \log_b 2$ b) $\log_b(\frac{1}{81}) = -4\log_b 3$

c) $\log_b\sqrt{5} = \frac{1}{2}\log_b 5$ d) $9^{\log_3 9} = 3$ e) $\log_2(8^n) = 3n$

16. Simplify: $\log_e e^{(x^2 + 9)}$

a) $\frac{x^2 + 9}{e}$ b) $9x^2$ c) $\log_e x^2 + \log_e 9$ d) $\log_e(x^2 + 9)$

e) $x^2 + 9$

17. Simplify: $\log_5 25^{(x - 3)}$

a) $\frac{x - 3}{2}$ b) $2x - 6$ c) $5x - 15$ d) $x - 3$ e) $2x - 3$

18. Solve for x: $\log_2(x^2 + 6x) = 4$

a) $-3 \pm \sqrt{13}$ b) $-8, 2$ c) 2 d) $-3 \pm \sqrt{17}$ e) no real solutions

19. Solve for x: $10^{\log_{10}(4x + 1)} = 81$

a) $\frac{71}{40}$ b) $\frac{(\log_{10}81) - 1}{4}$ c) ± 20 d) 20 e) no real solutions

For #20 and #21, express as a single logarithm and simplify if possible.

20. $2\log_b x - \frac{\log_b y}{3}$

a) $\log_b(\frac{x^2}{3y})$ b) $\log_b(\frac{x^2}{\sqrt[3]{y}})$ c) $\log_b(\frac{3x^2}{y})$ d) $\log_b(2x - \frac{y}{3})$

e) $\log_b(x^2 - \sqrt[3]{y})$

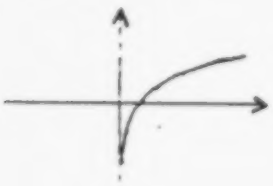
21. $\log_b(x^2 + 3x - 18) - \log_b(x - 3)$

a) $\log_b(x^2 + 2x - 15)$ b) $\log_b(x^2 + 2x - 21)$ c) $\log_b(x^3 - 27x + 54)$

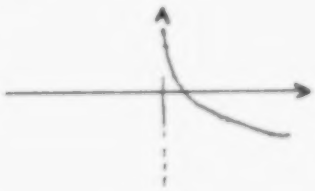
d) $\log_b(x + 6)$ e) $\log_b x + \log_b 6$

22. Which of the following could be the graph of $y = 2^x$?

a)



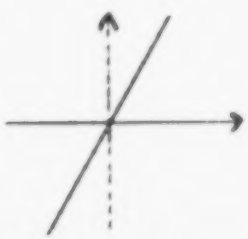
b)



c)

d)

e)



23. Find the domain of the function $f(x) = \log_3 x$.

a) all real numbers b) $\{x \mid x \geq 0\}$ c) $\{x \mid x > 0\}$

d) $\{x \mid x \neq 0\}$ e) $\{x \mid x > 1\}$

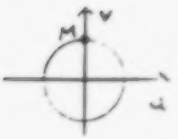
24. Which of the following is an x-intercept of the graph of $f(x) = \log_5 x - 1$

a) 5 b) 1 c) -5 d) $\frac{1}{5}$ e) no x-intercept

25. Solve: $\log x = 3.4048$

a) 2.54 b) 0.5315 c) 2540 d) 5.54 e) 5540

1. Given the unit circle, the coordinates of the point M are:



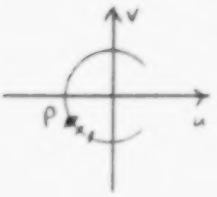
a) (0,2) b) (0,1) c) (1,1) d) (1,0) e) none of these

2. Given the unit circle, the coordinates of the point K are:

a) $(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2})$ b) $(-\sqrt{2}, \sqrt{2})$ c) $(\sqrt{2}, \sqrt{2})$

d) $(-\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2})$ e) $(\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2})$

3. Which two real numbers between -2π and 2π determine the point P on the unit circle?



a) $\frac{5}{3}\pi$ and $-\frac{5}{3}\pi$ b) $\frac{7}{6}\pi$ and $-\frac{7}{6}\pi$ c) $5\frac{\pi}{3}$ and $-\frac{2}{3}\pi$

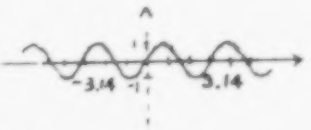
d) $\frac{5}{4}\pi$ and $-\frac{3}{4}\pi$ e) $\frac{7}{6}\pi$ and $-\frac{5}{6}\pi$

4. Which two real numbers between -2π and 2π determine the point Q on the unit circle?

a) $\frac{5}{4}\pi$ and $-\frac{\pi}{4}$ b) $\frac{5}{3}\pi$ and $-\frac{5}{3}\pi$ c) $\frac{5}{3}\pi$ and $-\frac{\pi}{3}$

d) $\frac{5}{4}\pi$ and $-\frac{3}{4}\pi$ e) π and $-\frac{\pi}{3}$

5. What is the period of this function?



a) 3.14 b) 1 c) -1 d) -3.14 e) 9

6. $\sin(-\frac{\pi}{4}) =$

a) $\frac{\sqrt{2}}{2}$ b) $\frac{2}{\sqrt{2}}$ c) 2 d) $\frac{1}{2}$ e) $-\frac{\sqrt{2}}{2}$

7. $\cos \pi =$

a) 0 b) 1 c) -1 d) does not exist e) none of these

8. The period of the cosine function is:

a) π b) $-\pi$ c) 2π d) -2π e) does not exist

9. The amplitude of the sine function is:

a) -1 b) 0 c) any real number d) 1 e) none of these

10. $\cos(x - 6\pi) =$

a) sin x b) -cos x c) cos x d) -sin x e) none of these

11. $\tan(-\frac{\pi}{2}) =$

a) 0 b) 1 c) -1 d) does not exist e) none of these

12. $\sec \frac{3}{4}\pi =$

a) $\frac{\sqrt{2}}{2}$ b) $\sqrt{2}$ c) $-\frac{\sqrt{2}}{2}$ d) $-\sqrt{2}$ e) none of these

13. $\cot(-\frac{3\pi}{2}) =$

a) 1 b) -1 c) 0 d) does not exist e) none of these

14. $\csc(-\frac{\pi}{6}) =$

a) $\frac{1}{2}$ b) $\frac{2}{\sqrt{3}}$ c) -2 d) $-\frac{2}{\sqrt{3}}$ e) 2

15. $\tan \frac{5\pi}{3} =$

a) $\sqrt{3}$ b) $-\sqrt{3}$ c) $\frac{1}{\sqrt{3}}$ d) $-\frac{1}{\sqrt{3}}$ e) does not exist

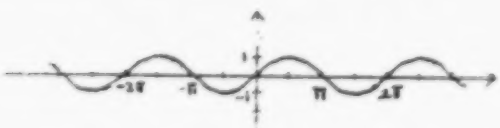
16. The period of the tangent function is:

a) 1 b) -1 c) any real number d) π e) $-\pi$

17. $\cot(x + \pi) =$

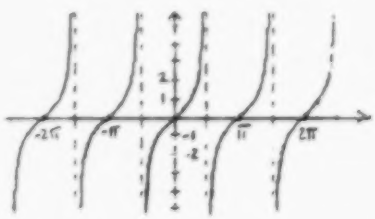
a) cot x b) tan x c) always positive d) -cot x e) -tan x

18. The following is the graph of:



a) y = sin x b) y = cos x c) y = sec x d) y = csc x
e) y = tan x

19. The following is the graph of:



a) y = sin x b) y = cos x c) y = sec x d) y = cot x
e) y = tan x

20. The amplitude of the tangent function is:

a) any real number b) π c) 2π d) does not exist
e) none of these

21. $\sin x \csc x =$

a) $\tan x$ b) $\frac{1}{\csc x}$ c) $\frac{1}{\cos x}$ d) 1 e) none of these

22. $\tan x \cot x =$

a) $\sin x$ b) $\cos x$ c) 1 d) $\sec x$ e) $\csc x$

23. $\sec x \sin x =$

a) 1 b) -1 c) $\cot x$ d) $\tan x$ e) $\csc x$

24. $\cos(-x) =$

a) $\cos x$ b) $-\cos x$ c) $\sec x$ d) $\frac{1}{\csc x}$ e) $\csc x$

25. $\sin(-x) =$

a) $\sin x$ b) $-\sin x$ c) $\sec x$ d) $\csc x$ e) $\frac{1}{\sec x}$

1. Find an identity for $\sin(x - \frac{\pi}{2})$

   a) $\cos\frac{\pi}{2}$ b) $\sin x$ c) $-\sin x$ d) $\cos x$ e) $-\cos x$

2. Find an identity for $\cos(\frac{\pi}{2} + x)$

   a) $\sin\frac{\pi}{2}$ b) $\sin x$ c) $-\sin x$ d) $\cos x$ e) $-\cos x$

3. Find an identity for $\tan(x - \frac{\pi}{2})$

   a) $\tan(-\frac{\pi}{2})$ b) $\tan x$ c) $-\tan x$ d) $\cot x$ e) $-\cot x$

4. Find an identity for $\csc(x + \frac{\pi}{2})$

   a) $\csc x$ b) $-\csc x$ c) $\sec x$ d) $-\sec x$ e) $\sec\frac{\pi}{2}$

5. Complete the identity. $\csc^2(\frac{3\pi}{2}) - 1 =$ ____

   a) $\cot^2\frac{3\pi}{2}$ b) $\tan^2\frac{3\pi}{2}$ c) $\sin^2\frac{3\pi}{2}$ d) $\cos^2\frac{3\pi}{2}$ e) $\sec^2\frac{3\pi}{2}$

6. Express tan x in terms of sec x

   a) $\tan x = \pm\sqrt{\sec^2 x + 1}$ b) $\tan x = \pm\sqrt{1 - \sec^2 x}$ c) $\tan x = \pm\sqrt{\sec^2 x - 1}$

   d) $\tan x = \sec x - 1$ e) $\tan x = \pm\sqrt{1 - \csc^2 x}$

7. $\sqrt{1 - \cos^2\theta}$

   a) $1 - \cos\theta$ b) $\sec\theta$ c) $\sqrt{\cos^2\theta}$ d) $|\sin\theta|$

   e) $\sin\theta$

   Given: $y = -2\cos\frac{x}{3}$

8. What is the amplitude of the function?

   a) $\frac{1}{3}$ b) 3 c) -2 d) 2 e) there is none

9. What is the period of the function?

   a) $\frac{1}{3}\pi$ b) $\frac{2\pi}{3}$ c) 6π d) -2 e) 2

   Given: $y = -\cot(2x - \frac{\pi}{2})$

10. What is the amplitude of the function?

    a) 1 b) -1 c) 2 d) $-\frac{1}{2}$ e) there is none

11. What is the period of the function?

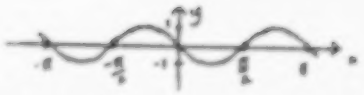
    a) 2π b) π c) $\frac{\pi}{2}$ d) $-\frac{\pi}{2}$ e) there is none

12. What is the phase shift of the function?

    a) $\frac{\pi}{4}$ b) $-\frac{\pi}{2}$ c) π d) $\frac{\pi}{2}$ e) $-\frac{\pi}{4}$

13. Sketch a graph of $y = \sin(2x - \pi)$

a)

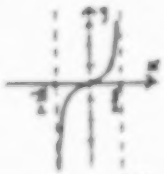
b) 

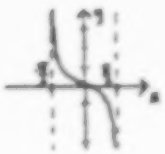
c)

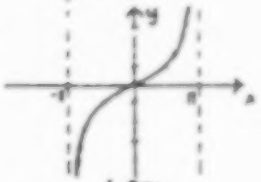
d)

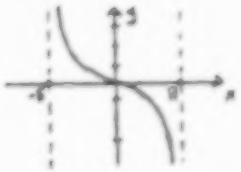
e) none of these

14. Sketch a graph of $y = -\tan \frac{1}{2} x$

a) 

b) 

c) 

d) 

e)

15. Given: . This is a sketch of the graph of

a) $y = \cos 2x$ b) $y = \sin 2x$ c) $y = \sec(\frac{1}{2} x)$ d) $y = -\sin(\frac{1}{2} x)$

e) $y = -\cos(\frac{1}{2} x)$

16. Determine the value of c so that the period of $y = \frac{1}{2} \sin cx$ will be $\frac{\pi}{2}$

a) 4 b) 2 c) $\frac{\pi}{2}$ d) $\frac{2}{\pi}$ e) $\frac{1}{2}$

17. Determine the value of c so that the period of $y = 2 \cot cx$ will be 4π

a) 4 b) 2 c) 4π d) $\frac{1}{4}$ e) $\frac{1}{2}$

18. Convert 495° to radian measure in terms of π

a) $\frac{3\pi}{4}$ b) $\frac{11\pi}{5}$ c) $-\frac{5\pi}{4}$ d) $\frac{5\pi}{4}$ e) $\frac{11\pi}{4}$

19. Convert -300° to radian measure in terms of π

a) $\frac{5\pi}{3}$ b) $\frac{\pi}{3}$ c) $\frac{5\pi}{6}$ d) $-\frac{5\pi}{3}$ e) $-\frac{\pi}{3}$

20. Convert 4 radians to degree measure (to the nearest degree)

a) 12° b) 229° c) 720° d) 240° e) 1440°

21. Convert $\frac{5\pi}{12}$ to degree measure

a) 75° b) $\frac{5^\circ}{4}$ c) 150° d) 225° e) none of these

22. Convert $-\frac{7\pi}{2}$ to degree measure

a) 90° b) -630° c) 270° d) -270° e) 630°

23. Find the length of an arc of a circle to the nearest hundredth, given a central angle of 135° and a radius of 3 in. (Use 3.14 for π)

a) 12.56 cm b) 14.14 cm c) 2.25 cm d) 405.00 cm e) 7.07 cm

24. An arc of 5 in., on a circle of radius 15 in., subtends an angle of how many radians?

a) 75 b) $\frac{1}{10}$ c) 3 d) $\frac{1}{3}$ e) 10

25. An arc 25 cm. long on a circle of radius 10 cm. subtends an angle of how many degrees, to the nearest degree?

a) 8° b) 23° c) 143° d) 450° e) 3°

MATH 3011 - MODULE 8

1. $\sin(-390^\circ) =$

   a) $-\frac{1}{2}$ b) $\frac{1}{2}$ c) 1 d) 0 e) does not exist

2. $\cos 840^\circ =$

   a) 2 b) -2 c) $\frac{1}{2}$ d) $-\frac{1}{2}$ e) $-\frac{2}{\sqrt{3}}$

3. $\tan\left(-\frac{7\pi}{3}\right) =$

   a) $-\frac{1}{\sqrt{3}}$ b) $\frac{1}{\sqrt{3}}$ c) $\sqrt{3}$ d) $-\sqrt{3}$ e) -1

4. $\cot(-7\pi) =$

   a) 0 b) 1 c) does not exist d) -1 e) none of these

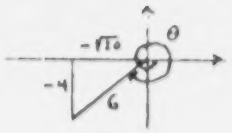
5. $\sec\frac{15\pi}{4} =$

   a) $\frac{\sqrt{2}}{2}$ b) $\sqrt{2}$ c) does not exist d) $-\sqrt{2}$ e) none of these

6. $\csc\left(-\frac{17\pi}{6}\right) =$

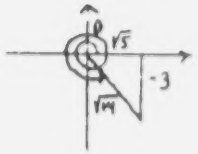
   a) 2 b) $\frac{1}{2}$ c) does not exist d) $-\frac{1}{2}$ e) -2

7. Given the angle θ in the diagram, then $\sec\theta =$



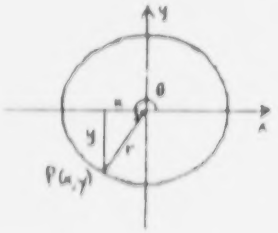
   a) $-\frac{\sqrt{5}}{3}$ b) $\frac{3}{\sqrt{5}}$ c) $-\frac{3}{\sqrt{5}}$ d) $\pm\frac{3}{\sqrt{5}}$ e) $-\frac{3}{2}$

8. Given the angle θ in the diagram, then $\tan\theta =$



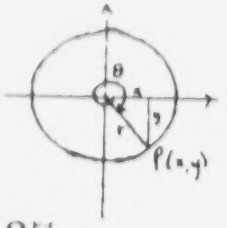
   a) $-\frac{3}{\sqrt{5}}$ b) $\frac{3}{\sqrt{5}}$ c) $\pm\frac{3}{\sqrt{5}}$ d) $\pm\frac{\sqrt{5}}{3}$ e) $-\frac{\sqrt{5}}{3}$

9. Consider the diagram where the point P is in the third quadrant. Which of the following is <u>false</u>?



   a) x is a negative number
   b) y is a negative number
   c) $\sin\theta = \frac{y}{r}$
   d) r is a positive number
   e) r is a negative number

10. Consider the diagram where the point P is in the fourth quadrant. Which of the following is <u>false</u>?



   a) $\cos\theta$ is a positive number
   b) $\tan\theta$ is a negative number
   c) $\cos\theta = \frac{x}{r}$
   d) r is a positive number
   e) $\sec\theta = \frac{r}{y}$

11. Given $\sec\theta > 0$, which of the following is impossible?

a) $\sin\theta < 0$ b) $\cos\theta < 0$ c) $\tan\theta < 0$ d) $\cot\theta < 0$

e) any of the above conditions are possible

12. Given that $\cot\theta = -\frac{4}{3}$ and that θ is in the second quadrant, the value of $\csc\theta$ is

a) $\frac{5}{3}$ b) $-\frac{5}{3}$ c) $-\frac{3}{5}$ d) $-\frac{5}{4}$ e) $-\frac{4}{5}$

13. Given that $\sin\theta = -\frac{\sqrt{24}}{5}$ and that θ is in the fourth quadrant, the value of $\tan\theta$ is

a) $\sqrt{24}$ b) $\frac{1}{\sqrt{24}}$ c) $\frac{5}{\sqrt{24}}$ d) $-\frac{1}{\sqrt{24}}$ e) $-\sqrt{24}$

14. Given that $\sin 37^\circ = .6458$, which of the following statements is <u>correct</u>?

a) $\cos 37^\circ = .6458$ b) $\cos 53^\circ = .6458$ c) $\tan 37^\circ = .6458$

d) $\sin 53^\circ = .6458$ e) none of these

15. Given that $\tan\theta = \frac{2}{3}$, which of the following statements is <u>false</u>?

a) $\cot\theta = \frac{3}{2}$ b) $\tan(\theta + \pi) = \frac{2}{3}$ c) $\cot(90^\circ - \theta) = \frac{2}{3}$

d) $\sin\theta = 2$ e) $\tan(\theta - 2\pi) = \frac{2}{3}$

Find the equivalent expression.

16. $\frac{\cos x - \sin x}{\cos x} =$

a) $1 - \sin x$ b) $\cos x - \tan x$ c) $-\tan x$ d) $1 - \tan x$

e) none of these

17. $\tan y(\tan y + \cot y) =$

a) $\tan^2 y$ b) $\sec^2 y$ c) $\tan y + 1$ d) $\csc^2 y$ e) $\tan^2 y + \cot y$

18. $\frac{1 + \cos x}{\sin x} + \frac{\sin x}{\cos x} =$

a) $\frac{1 + \cos x}{\sin x \cos x}$ b) $\frac{2}{\sin x \cos x}$ c) $\frac{1}{\sin x \cos x}$ d) $\frac{1 + \cos x + \sin x}{\sin x + \cos x}$

e) 1

19. $\frac{\sin x}{1 - \cos x} + \frac{1 - \cos x}{\sin x} =$

a) 2 b) $\frac{2}{(1 - \cos x)\sin x}$ c) $\sin x + \cos^2 x$ d) $\frac{2}{\sin x}$ e) 1

20. $\sin y(\csc y - \sin y) =$

a) $1 - \sin y$ b) 0 c) $\cos^2 y$ d) $\sin^2 y$ e) $1 + \sin^2 y$

21. $\sin^2\theta \cot^2\theta + \sin^2\theta =$

a) $\sin^2\theta \cot^2\theta$ b) 1 c) $\sin^2\theta \sec^2\theta$ d) $\sin^4\theta \cot^2\theta$
e) $2\sin^2\theta \cot^2\theta$

22. $\sin x + \dfrac{\cos^2 x}{\sin x} =$

a) $\sin x + \tan x$ b) $\cos^2 x$ c) $\csc x$ d) $\dfrac{\sin x + \cos^2 x}{\sin x}$
e) $\sin x + \tan^2 x$

23. $\tan^4\theta + \tan^2\theta =$

a) $\tan^6\theta$ b) $\dfrac{1}{\cos^2\theta}$ c) $\tan^2\theta \sec^2\theta$ d) $\sec^2\theta$ e) $\sec^4\theta$

24. $\sin^3 x + \sin x \cos^2 x =$

a) 1 b) $\sin x$ c) $2 \sin x$ d) $\sin x \cos x$ e) none of these

25. $(\sin x - \cos x)^2 =$

a) 1 b) 0 c) $1 - 2\sin x \cos x$ d) $\sin^2 x + \cos^2 x$
e) $\sin^2 x - \cos^2 x$

MATH 3011 - MODULE 9

Simplify all answers as far as possible without using decimal approximations.

1. Use $75^\circ = 45^\circ + 30^\circ$ and the appropriate formula to find $\sin 75^\circ$.

   a) $\frac{\sqrt{2}+1}{2}$ b) $\frac{\sqrt{6}+\sqrt{2}}{4}$ c) $\frac{\sqrt{6}-\sqrt{2}}{4}$ d) $\frac{\sqrt{2}-1}{2}$ e) $\frac{\sqrt{8}}{4}$

2. Simplify: $\sin 75^\circ \cos 5^\circ - \cos 75^\circ \sin 5^\circ$

   a) $\cos 80^\circ$ b) 0 c) $\sin 80^\circ$ d) $\sin 70^\circ$ e) none of these

3. Simplify: $\cos 2x \cos 3x - \sin 2x \sin 3x$

   a) $-\sin x$ b) $\cos x$ c) $\cos 5x$ d) $-\cos x$ e) none of these

4. Simplify: $\cos \frac{\pi}{5} \cos \frac{\pi}{10} + \sin \frac{\pi}{5} \sin \frac{\pi}{10}$

   a) $\cos \frac{3\pi}{10}$ b) $-\cos \frac{3\pi}{10}$ c) $\cos \frac{\pi}{10}$ d) $\sin \frac{\pi}{10}$ e) $-\cos \frac{\pi}{10}$

5. Use $\frac{\pi}{12} = \frac{\pi}{3} - \frac{\pi}{4}$ and the appropriate formula to find $\cos \frac{\pi}{12}$

   a) $\frac{1-\sqrt{2}}{2}$ b) $\frac{\sqrt{6}+\sqrt{2}}{4}$ c) $\frac{\sqrt{6}-\sqrt{2}}{4}$ d) $\frac{1}{2}$ e) $\frac{1+\sqrt{2}}{2}$

6. Given $\sin\theta = \frac{4}{5}$ and $\cos\theta = \frac{3}{5}$ find $\sin(\theta + 45^\circ)$

   a) $\frac{6+5\sqrt{2}}{10}$ b) $\frac{16+5\pi}{20}$ c) $\frac{8+5\sqrt{2}}{10}$ d) $\frac{-\sqrt{2}}{10}$ e) $\frac{7}{10}\sqrt{2}$

7. Which of the following is <u>true</u> for all real numbers x ?

   a) $\sin 3x = 3 \sin x$ b) $\cos 2x = 2\cos^2 x - 1$ c) $\cos \frac{x}{2} = \frac{1}{2} \cos x$

   d) $\sin^4 x + \cos^4 x = 1$ e) $\cos^2 x - \sin^2 x = -1$

8. Use the identity $\cos 2x = 1 - 2\sin^2 x$ to simplify $1 - \cos 2x$

   a) $2\sin^2 x$ b) $-2\sin^2 x$ c) 0 d) $1 - 2\sin^2 x$ e) $1-\sin 2x$

9. Simplify: $2 \sin 25^\circ \cos 25^\circ$

   a) $\sin 12.5^\circ$ b) $2 \sin 12.5^\circ$ c) $2 \sin 50^\circ$ d) $\cos 50^\circ$
   e) $\sin 50^\circ$

10. Simplify: $\cos^2 3x - \sin^2 3x$

    a) $\cos 6x$ b) -1 c) $3 \cos 2x$ d) $2 \cos 3x$ e) $\cos \frac{3}{2} x$

11. Simplify: $\frac{2 \tan 40^\circ}{1 - \tan^2 40^\circ}$

    a) $\tan 20^\circ$ b) 0 c) $\tan 80^\circ$ d) $\tan 1600^\circ$ e) $\cot 80^\circ$

12. Simplify: $\sin 35^\circ \sin 5^\circ - \cos 35^\circ \cos 5^\circ$

a) $\cos 30^\circ$ b) $\cos 40^\circ$ c) $-\cos 40^\circ$ d) $\sin 40^\circ$ e) $\sin 30^\circ$

For #13 through #15, let θ be an angle in quadrant III such that $\sin \theta = \frac{-3}{5}$

13. Find $\sin 2\theta$

a) $-\frac{4}{5}$ b) $-\frac{6}{5}$ c) $\frac{24}{25}$ d) $\frac{24}{5}$ e) $-\frac{24}{25}$

14. Find $\cos 2\theta$

a) $-\frac{6}{5}$ b) $\frac{-7}{25}$ c) $-\frac{8}{5}$ d) 1 e) $\frac{7}{25}$

15. Find the quandrant in which the angle 2θ lies.

a) I b) II c) III d) IV

e) cannot be determined from the information given

For #16 through #18, let θ be an angle in quadrant IV such that $\cos \theta = \frac{1}{3}$

16. Find $\cos 2\theta$

a) $-\frac{4}{3}\sqrt{2}$ b) $-\frac{2}{3}\sqrt{2}$ c) $\frac{7}{9}$ d) $-\frac{7}{9}$ e) $\frac{2}{3}$

17. Find $\sin 2\theta$

a) $\frac{4}{9}\sqrt{2}$ b) $-\frac{4}{9}\sqrt{2}$ c) $-\frac{7}{9}$ d) $\frac{\sqrt{2}}{3}$ e) $\frac{4}{3}\sqrt{2}$

18. Find $\sin(\theta + 60^\circ)$

a) $-\frac{2}{3}\sqrt{2} + \frac{\sqrt{3}}{2}$ b) $-\frac{2}{3}\sqrt{2} + \frac{\pi}{3}$ c) $\frac{-2\sqrt{2} + \sqrt{3}}{6}$ d) $\frac{-4\sqrt{6}}{6}$ e) $\frac{\sqrt{2} - 4}{6}$

19. Simplify: $4 \sin 6x \cos 6x$

a) $\sin 24x$ b) $12 \sin 2x$ c) $8 \sin 12x$ d) $4 \sin 12x$ e) $? \sin 12x$

20. Find the exact value of $\sin 15^\circ$ using $15^\circ = \frac{1}{2}(30^\circ)$ and the half-angle formula for sine.

a) $\frac{1}{4}$ b) $\frac{\sqrt{3}}{4}$ c) $\frac{1}{2}\sqrt{2 - \sqrt{3}}$ d) $\frac{1}{2}\sqrt{1 - \sqrt{3}}$ e) $\frac{1}{2}\sqrt{2 + \sqrt{3}}$

21. Find the exact value of $\cos \frac{5\pi}{8}$ using $\frac{5\pi}{8} = \frac{1}{2}(\frac{5\pi}{4})$ and the half-angle formula for cosine.

a) $-\frac{1}{2}\sqrt{2 + \sqrt{2}}$ b) $-\frac{1}{2}\sqrt{1 + \sqrt{2}}$ c) $-\frac{\sqrt{2}}{4}$ d) $\frac{\sqrt{2}}{4}$ e) $-\frac{1}{2}\sqrt{2 - \sqrt{2}}$

22. Use an appropriate formula to eliminate the exponent: $2 \sin^2 x$

a) $4 \sin x$ b) $1 - \cos 2x$ c) $\sin x$ d) $1 + \cos 2x$ e) $\frac{1 - \cos 2x}{2}$

23. Simplify: $\sin(\alpha + \beta) - \sin(\alpha - \beta)$

a) $2\cos\alpha\sin\beta$ b) $2\sin\beta$ c) 0 d) $\sin 2\beta$ e) $-2\sin\alpha\sin\beta$

24. If $\sin\theta = \frac{5}{13}$ and θ is in quadrant I, find $\sin\frac{\theta}{2}$

a) $\frac{5}{26}$ b) $\frac{120}{169}$ c) $\frac{2}{\sqrt{13}}$ d) $\frac{1}{\sqrt{26}}$ e) $\frac{10}{13}$

25. Use an appropriate formula to eliminate the exponent: $\cos^2 4x$

a) $2(1 + \cos 2x)$ b) $\cos 16x$ c) $\frac{1 + \cos 8x}{2}$ d) $2(1 + \cos 8x)$

e) $2\cos 4x$

MATH 3011 - MODULE 10

Find the equivalent expression.

1. $\frac{\sin x}{\cos x} + \frac{\cos x}{\sin x}$

   a) 2 b) secx cscx c) $\frac{1}{\cos x + \sin x}$ d) 2 tan x

   e) none of these

2. $\frac{\sin 2y}{2 \sin^2 y}$

   a) $\frac{1}{2}$ b) cot y c) $\frac{1}{\sin y}$ d) sec y e) none of these

3. $\frac{1 - \cos 2x}{\sin 2x}$

   a) tan x b) 0 c) -cot x d) $\frac{1 + \cos x}{\sin x}$ e) none of these

4. $\frac{2 \tan\theta}{1 + \tan^2\theta}$

   a) $\frac{2}{1 + \tan\theta}$ b) $\frac{1}{\cos \theta}$ c) $\frac{1}{\sin \theta}$ d) sin 2θ e) none of these

5. $\frac{\sin(x + y)}{\cos x \cos y}$

   a) tanx tany b) $\frac{\tan x}{\cos y} + \frac{\tan y}{\cos x}$ c) cot x + cot y

   d) tanx + tany e) none of these

6. $\frac{2 \tan x}{\sin 2x}$

   a) $\sec^2 x$ b) $\frac{2}{\cos x}$ c) $\cos^2 x$ d) $\frac{\tan x}{\sin x}$ e) none of these

7. $\sin \frac{x}{2} \cos \frac{x}{2}$

   a) 1 b) $\frac{\sin x}{2}$ c) $\frac{\cos x}{\sqrt{2}}$ d) cot x e) none of these

8. $\frac{\sin x}{1 - \cos x}$

   a) 1 - tan x b) $\frac{1}{\sin x}$ c) $\frac{1 + \cos x}{\sin x}$ d) $\frac{1 - \cos x}{\sin x}$ e) 1

9. $2 \cos^2 \frac{x}{2} - \cos x$

   a) 2 cosx sinx b) $\tan \frac{x}{2}$ c) $\sin \frac{x}{2}$ d) -1 e) 1

10. $\cos^4 y - \sin^4 y$

    a) 1 b) $\cos^2 y$ c) cos 2y d) sin 2y e) none of these

11. $(\sin x + \cos x)^2$

a) 1 b) $1 + \sin 2x$ c) $1 + \cos 2x$ d) $2 + \cos 2x$

e) none of these

12. $\dfrac{\sin 2x}{\cos^2 x}$

a) $1 - \sin^2 x$ b) $\tan x$ c) $2 \tan x$ d) $-\sin^2 x$

e) none of these

13. $\dfrac{1}{1 + \cos A} + \dfrac{1}{1 - \cos A}$

a) $2 \csc^2 A$ b) $\dfrac{1}{\cos 2A}$ c) $\dfrac{2}{\sin A \cos A}$ d) 2 e) none of these

Simplify:

14. $i^9 - i^{15}$

a) $-i$ b) -1 c) $2i$ d) 0 e) 2

15. $(3 - 2i)(-2 + 5i)$

a) $-16 + 19i$ b) $5 + 11i$ c) 4 d) $4 + 19i$ e) none of these

16. $(4 - 5i) - (-7 - i)$

a) $11 - 4i$ b) $3 - 4i$ c) $-3 - 6i$ d) $11 - 6i$ e) none of these

17. Assume x and y are real numbers and solve for x and y:

$$2x - 3 - 7i = 12 + (6 + y)i$$

a) $x = 6, y = -19$ b) $x = \frac{15}{2}, y = -13$ c) $x = 9, y = 1$

d) $x = \frac{15}{2}, y = 1$ e) none of these

18. Divide: $\dfrac{4 - i}{3 + 5i}$

a) $\frac{7}{34} + \frac{23}{34} i$ b) $\frac{4}{3} - \frac{1}{5} i$ c) $-\frac{17}{34} + \frac{23}{34} i$ d) $-\frac{17}{16} + \frac{23}{16} i$

e) $\frac{7}{34} - \frac{23}{34} j$

19. Find a solution: $x^2 - 2x + 10 = 0$

a) $2 + 6i$ b) $1 + 3i$ c) $1 + 6i$ d) $2 + 3i$ e) none of these

Find the reciprocal and express it in the form of $a + bi$.

20. $3 + 2i$

a) $\frac{3}{5} - \frac{2}{5} i$ b) $\frac{3}{5} + \frac{2}{5} i$ c) $\frac{3}{13} + \frac{2}{13} i$ d) $\frac{3}{13} - \frac{2}{13} i$

e) none of these

21. Assume x and y are real numbers and solve for x and y:

$2x + y + 2yi = 3 + 6i$ then $x + y$ will equal:

a) 6 b) 4 c) 3 d) 1 e) 0

22. $\frac{4 - i}{6 + i} - \frac{2 - i}{6 - i}$

a) $\frac{10}{37} - \frac{14}{37} i$ b) $\frac{13}{37} - \frac{6i}{37}$ c) $\frac{10}{35} - \frac{14i}{35}$ d) $\frac{13}{37} + \frac{6}{37} i$

e) $\frac{10}{37} - \frac{6}{37} i$

23. $i^{20} - i^{55} + i^{18} - i^{101}$

a) -1 b) 1 c) 0 d) 1 e) -i

24. $(4 - 7i)^2$

a) $16 + 49i$ b) $-33 - 56i$ c) 65 d) $65 - 28i$ e) none of these

25. $\frac{\sqrt{6} + 2i}{\sqrt{6} - 2i}$

a) $\frac{1}{2} + \frac{1\sqrt{6}}{2} i$ b) $\frac{1}{2} - 2\sqrt{6}\, i$ c) $\frac{1}{5} + \frac{1\sqrt{6}}{5} i$ d) $\frac{1}{5} + \frac{2\sqrt{6}}{5} i$

e) $1 - i$

1. Determine the degree of the polynomial $5x^3 - 2x + \sqrt{3}$

   a) 0 b) 1 c) 2 d) 3 e) 4

2. Determine the degree of the polynomial $\pi^2 - 5x + 4$

   a) 0 b) 1 c) 2 d) 3 e) 4

3. Determine whether -4, -2 and 2 are roots of $P(x) = 3x^3 + 10x^2 - 16x - 32$

   a) -4, -2 and 2 are roots
   b) -4 and -2 are roots; 2 is not a root
   c) -4 and 2 are roots; -2 is not a root
   d) -2 and 2 are roots; -4 is not a root
   e) -4 is a root; -2 and 2 are not roots

4. Find $P(-3)$. $P(x) = x^5 + 4x^2 - 2x + 7$

   a) 22 b) -194 c) 130 d) 64 e) 108

5. Find the quotient and remainder when $8x^3 - 12x^2 + 4x - 2$ is divided by $4x - 2$

   a) $2x^2 - 2x$, $R = 0$ b) $8x^3 - 12x^2$, $R = 0$ c) $2x^2 - 4x + \frac{1}{2}$, $R = -1$

   d) $2x^2 - 2x$, $R = -2$ e) $2x^2 - 4x + 3$, $R = -8$

6. Find the quotient and remainder when $-2x^2 + x + 5$ is divided by $2x + 3$

   a) $-x + 2$, $R = -1$ b) $-x + 2$, $R = 11$ c) $x + 1$, $R = 2$

   d) $x - 1$, $R = 2$ e) $x + 2$, $R = -1$

7. Find the quotient and remainder when $2x^2 + x + 1$ is divided by $4x - 6$

   a) $\frac{1}{2}x + 1$, $R = -7$ b) $\frac{1}{2}x + 1$, $R = -5$ c) $\frac{1}{2}x - \frac{1}{2}$, $R = 4$

   d) $\frac{1}{2}x + \frac{1}{2}$, $R = -2$ e) $\frac{1}{2}x + 1$, $R = 7$

8. Find the remainder when $21x^3 + 14x + 6$ is divided by $x + 2$

   a) 146 b) 62 c) -190 d) 202 e) none

9. For $P(x) = x^3 + 2x^2 - x - 2$, which of the following are factors of $P(x)$?

   i. $x + 1$ ii. $x - 2$ iii. $x + 2$

   a) i b) ii c) i and ii d) i and iii e) i, ii and iii

10. For $P(x) = x^3 + 2x^2 - 5x - 6$, which of the following are factors of $P(x)$?

    i) $x + 2$ ii. $x - 3$ iii. $x^2 + x - 6$

    a) i b) ii c) iii d) i, ii and iii e) ii and iii

11. Find the remainder: $(3x^3 - 8x^2 - x + 12) \div (x^2 - x - 2)$

a) 0 b) 2 c) -6 d) $4x + 34$ e) $-6x + 2$

12. Given $f(x) = 2x + 3$, when we divide $f(x)$ by $-x + 4$ the quotient is -2 and the remainder is 11. Which one of the following statements is <u>false</u>?

a) $2x + 3 = -2(-x + 4) + 11$ b) $f(4) = 11$ c) $\frac{2x + 3}{-x + 4} = -2 + \frac{11}{-x + 4}$

d) $\frac{2x + 3}{-x + 4} = -2 - \frac{11}{-x + 4}$ e) $-\frac{3}{2}$ is a root of $f(x) = 0$

13. Given $f(x) = 3x^2 + x - 1$, when we divide $f(x)$ by $x + 2$ the quotient is $3x - 5$ and the remainder is 9. Which one of the following statements is <u>false</u>?

a) $3x^2 + x - 1 = (x + 2)(3x - 5) + 9$ b) $\frac{3x^2 + x - 1}{x + 2} = (3x - 5) + \frac{9}{x + 2}$

c) $\frac{3x^2 + x - 1}{x + 2} = 3x - 5 + 9$ d) $f(-2) = 9$

e) -2 <u>is not</u> a root of $f(x) = 0$

14. Use synthetic division to determine the quotient $(x^3 - 1) \div (x - 1)$

a) x^2 b) $x^2 - 2x$ c) $x^2 - x + 1$ d) $x^2 + x + 1$ e) $x^2 + 1$

15. A third degree equation with real coefficients has roots $1 + i$ and -2. What is the third root?

a) 2 b) $-1 + i$ c) $-1 - i$ d) $1 + i$ e) none of these

16. A fourth degree polynomial with real coefficients has zeros $2i$ and $1 - 3i$. What are the other two zeros?

a) $2i$ and $1 - 3i$ b) $-2i$ and $1 - 3i$ c) $-2i$ and $1 + 3i$

d) $2i$ and $1 + 3i$ e) none of these

Use $P(x) = (2x^2 - 5x - 3)(x + 1)^2$ for problems 17 and 18.

17. State the degree of the polynomial

a) 2 b) 3 c) 4 d) 5 e) none of these

18. Find all roots, with multiplicity, of the polynomial

a) $-1, -\frac{1}{2}, 3$ b) $-3, 1, \frac{1}{2}$ c) 1(multiplicity 2), $-\frac{1}{2}$, 3

d) -3, -1(multiplicity 2), $\frac{1}{2}$ e) -1(multiplicity 2), $-\frac{1}{2}$, 3

19. Find the zeros, with multiplicity, of the polynomial function $P(x) = 3(x^2 - 4x + 4)(x^2 - 16)$

a) $-4, -2, 3, 4$ b) -4, -2(multiplicity 2), 3, 4 c) $-4, -2, 4$

d) -2(multiplicity 2), 4 e) none of these

20. Find the zeros, with multiplicity, of the polynomial function $P(x) = 2x(3x^2 - 2x - 5)^2(x - 2)$

a) -1(multiplicity 2), 0, $\frac{5}{3}$(multiplicity 2), 2 b) -1, 0, $\frac{5}{3}$, 2

c) -1(multiplicity 2), $\frac{5}{3}$(multiplicity 2), 2

d) $-\frac{5}{3}$(multiplicity 2), 1(multiplicity 2), 2 e) none of these

21. Find a polynomial of degree 3 that has $\frac{1}{2}$, -2 and 3 as roots

a) $(x + \frac{1}{2})(x - 2)(x + 3)$ b) $2x^3 + 3x^2 - 11x - 6$ c) $x^3 - 2x^2 - 5x + 6$

d) $2x^3 + 9x^2 + 7x - 6$ e) $2x^3 - 3x^2 - 11x + 6$

22. Find a polynomial of lowest degree, with rational coefficients, that has $-2i$ and 3 as two of its roots.

a) $x^3 - 3x^2 - 4x + 12$ b) $x^3 - 3x^2 + 4x - 12$ c) $x^2 + 5x + 6$

d) $x^3 + 3x^2 + 4x + 12$ e) $x^3 + 3x^2 - 4x - 12$

Given that the polynomial or polynomial equation has the given root, find the other roots.

23. $x^3 - 4x^2 + x + 6$; 2

a) -3, 1 b) -3, -1 c) 3, 1 d) 3, -1 e) none of these

24. $2x^3 - 3x^2 + 8x - 12 = 0$, $\frac{3}{2}$

a) ± 2 b) 2(double root) c) -2(double root) d) 2i(double root)

e) $\pm 2i$

25. $x^4 + 2x^3 - 3x^2 - 8x - 4$; 2, -2

a) 1, -1 b) 1(double root) c) -1(double root)

d) 1, 2(double root) e) none of these

Use the quadratic formula to solve the equations in problems 1 and 2. (Simplify answers)

1. $3x^2 - 2x - 7 = 0$

   a) $\frac{1 \pm 2\sqrt{22}}{3}$ b) $\frac{-1 \pm \sqrt{22}}{3}$ c) $\frac{1 \pm \sqrt{88}}{3}$ d) $\frac{1 \pm \sqrt{22}}{3}$

   e) none of these

2. $3x^2 = 6x - 2$

   a) $\pm 2\sqrt{3}$ b) $\frac{3 \pm \sqrt{3}}{3}$ c) $\frac{6 \pm \sqrt{12}}{6}$ d) $1 \pm \sqrt{12}$ e) none of these

3. Solve: $x^3 + x^2 = x + 1$

   a) there is just one solution b) there are two solutions, both negative
   c) there are three distinct solutions
   d) there are two solutions, both positive e) none of these

4. One root of the equation $x^3 - x - 6 = 0$ is 2. The other roots are

   a) rational and equal b) rational and unequal c) irrational
   d) rational and irrational e) none of these

List all of the possible rational roots of the following equations.

5. $x^3 - 7x + 6 = 0$

   a) $\pm (1,2)$ b) $\pm (1,2,3,6)$ c) $\pm (1,2,3,4)$ d) $\pm (1,2,3)$

   e) none of these

6. $4x^3 - 25x^2 - 8 = 0$

   a) $\pm (1,2,4,8)$ b) $\pm (1,2,4)$ c) $\pm(1,2,8)$ d) $\pm (\frac{1}{4},\frac{1}{2},1,2,4,8)$

   e) none of these

7. Given that $x^3 - 1 = 0$ has 1 as a root, find the other roots.

   a) $-1, \frac{-1 \pm i\sqrt{3}}{2}$ b) $\frac{1 \pm i\sqrt{3}}{2}$ c) $1 \pm i$ d) $\frac{-1 \pm i\sqrt{3}}{2}$

   e) none of these

8. Solve the equation $x^3 + x^2 - 10x + 8 = 0$. The sum of the roots is equal to

   a) 1 b) 2 c) 3 d) -1 e) -3

Use this equation for problems 9 and 10: $2x^4 - 5x^3 - 3x^2 + 4x + 2 = 0$

9. The possible rational roots of this equation are:

   a) $\pm (1,2)$ b) $\pm (1,2,4)$ c) $\pm (1,2,\frac{1}{2},\frac{1}{4})$ d) $\pm (1,2,\frac{1}{2})$

   e) none of these

10. The roots of this equation are

a) all rational b) all irrational c) rational and complex
d) rational and irrational e) all complex

11. The positive roots of the equation $x^5 - 5x^3 + 4x = 0$ lie between

a) 2 and 4 b) 3 and 7 c) -1 and 3 d) 1 and 3
e) none of these

12. Given the equation $x^3 - 4x^2 + x + 6 = 0$. The roots of this equation all lie between

a) -7 and -3 b) -5 and 2 c) 0 and 4 d) -2 and 4
e) none of these

13. In expanding the binomial $(a + b)^{10}$, the exponent of b in the seventh term is

a) 3 b) 5 c) 7 d) 9 e) none of these

14. Find the third term of $(2a - b)^8$

a) $-1792a^6b^2$ b) $256a^8b^8$ c) $1792a^6b^2$ d) $56a^2b^6$
e) $-320a^5b^3$

15. Find the middle term of $(x + \frac{1}{2}y)^6$

a) $\frac{5}{2}x^3y^3$ b) $10x^3y^3$ c) $\frac{15}{4}x^4y^2$ d) $\frac{15}{2}x^4y^2$ e) $\frac{15}{16}x^2y^4$

16. Expand: $(3x - y)^4$

a) $81x^4 + y^4$
b) $81x^4 - 108x^3y + 54x^2y^2 - 12xy^3 + y^4$
c) $3x^4 - 12x^3y + 18x^2y^2 - 12xy^3 + y^4$
d) $3x^4 + y^4$
e) $81x^4 - y^4$

17. Find the 5th term of $(4 + \sqrt{x})^7$

a) $64x^2$ b) $35x^{5/2}$ c) $2240x^2$ d) $64\sqrt{x}$ e) $21,504x$

18. Expand: $(a + b^2)^3$

a) $a^3 + b^6$
b) $a^3 + 3a^2b + 6ab^2 + b^3$
c) $a^3 + 3a^2b + 3ab^2 + b^3$
d) $a^3 + 3a^2b^2 + 3ab^4 + b^6$
e) $a^3 + b^5$

19. Find the 2nd term of $(x^2 + \sqrt{3})^5$

a) $5\sqrt{3}\,x^2$ b) $\sqrt{3}\,x^8$ c) $5\sqrt{3}\,x^8$ d) $5\sqrt{3}\,x^4$ e) $90x^6$

20. In expanding $(x - \frac{1}{y})^5$, the coefficient of the $\frac{x^2}{y^3}$ is

a) 5 b) -5 c) 10 d) -10 e) $-\frac{5}{3}$